REMARKS

Request for Continued Examination:

An RCE is enclosed herewith.

Drawing Corrections:

Applicant respectfully traverses the requirement for corrected drawings. The invention as claimed is a method that is performed using a computer. Claim 1 simply refers to use of a computer in a specified way. As stated in 37 C.F.R. 1.81(b), "Drawings may include illustrations which facilitate an understanding of the invention (for example, flow sheets in cases of processes. . .) Flow diagrams are already included in the drawings as Figs. 3A and 3B. Indeed, these represent the programmed general-purpose computer referred to in claim 1. There is no need for a further drawing of an apparatus in such circumstances since the drawing would consist only of a block labeled "programmed general purpose computer" or the like. For the Examiner to require such a drawing is not believed to be warranted.

Status of Claims

Claims 2-15, 7, 8, and 20-44 are present and under examination in the application at this time. Of these, claims 2-4, 6-10, 13-15, 17, 18, and 20-26, and 28-33 are currently amended, and claims 5, 11-12, and 27 remain in their original or previously presented form. Claims 34-44 are new. No new matter has been introduced by the amendments or the new claims.

Claims 1 has been canceled and replaced by new claim 42. Some of the claims dependent on claim 1 have now been made dependent on claim 42. The dependencies of some others has been changed as well.Claim 16 is canceled hereby. Claim 19 was previously canceled.

Rejection of Claims under 35 U.S.C. 112

Preliminarily, the following example is offered of the distinction between "physical space" and "discrete space". Imagine that this is 100 years ago, and you have decided to walk from Alexandria, VA to Winchester, VA. There are still lots of open spaces in between, as well as roads. All paths, including across fields, etc. are valid, not only along the roads. This is *physical space.*

In discrete space only the roads are deemed to define valid paths. Clearly determining a path in physical space is much more complex than just picking the best path from a database of path costs for segments of a map. The problem addressed by the claims is to determine a good path computed in a reasonable amount of time. Clearly, this is a more practical solution than trying to find the best path by considering the infinite number of possible paths from S to T.

Claim 42: The rejection of previous claim 1 was based on the purported fact the specification does not provide a person having ordinary skill in the art with an understanding as to the meaning of "predefined path segments". Applicant respectfully traverses this rejection.

`To begin with, it is presumed that the Examiner recognizes that the wording of claim 1 was intended to *exclude* limitation to predefined path segments. It is respectfully submitted that a person having ordinary skill in the art would understand that the claim is simply saying that the final computed path from the start point S to the termination point T is not constrained by an *a priori* limited number of ways to get there. It is not believed that the phrase has any special meaning. The words would mean the same thing to anyone with a reasonable command of the English language.

Nevertheless, in an effort to expedite the prosecution, the objected-to phrase has been deleted from claim 42, and a new dependent claim 35 is directed to this feature. However, claim 35 uses the phrase "predetermined alternative routes". This phraseology is used in the specification on page 7, lines 16-19 in the context of a travel guidance system. It is respectfully submitted that a person having ordinary skill in the art would immediately understand from reading the specification what the claim is directed to.

Claim 22: In respect to the rejection under 35 U.S.C. 112, first paragraph, this appears to be on the basis that the specification purportedly does not support the term "gradient method". Applicant respectfully traverses this rejection. Actually, the term used in claim 22 is "gradient descent method". In any event, it remains applicant's position that a gradient descent method is a standard and well-known computer algorithm that will immediately be recognized and understood by a person having ordinary skill in the art. The reference to the Wikipedia discussion on this subject was only to provide the Examiner background information. Further, the Examiner's comment that this "is not relied on to be a source which can be cited" is not understood.

Nevertheless, in a further effort to demonstrate that gradient descent methods are well known, the Examiner is referred also to Sutton and Barto, *Reinforcement Learning: An Introduction*, 1998, The MIT Press, Cambridge, Massachusetts, London, England, Section 8.2, and to Kivinen and Warmuth, *Exponentiated Gradient versus Gradient Descent for Linear Predictors,* 1997 Academic Press. Other authoritative references abound.

In respect to the rejection under the second paragraph of 35 U.S.C. 112, applicant respectfully states that the basis for the rejection is not understood. The reference to the response filed 05-04-2010, simply refers to the fact, as stated above, that a gradient descent method is a type of computer algorithm known to persons having ordinary skill in the art. It does not follow that such a reference demonstrates that the invention is different from what is described in claim 22. Moreover, it is not understood what the Examiner means by "applicant has failed to describe what the invention is as it pertains to their invention". If the Examiner persists in this rejection, he is respectfully requested to explain the basis for the rejection more clearly.

Claim 27: This rejection appears to be based on the Examiner's unfamiliarity with the concept of the term "heap" in the context of the claim. In response, applicant again notes that the reference is to a standard term of art, and is supported and well described in the specification at page 14, line 27-page 15, line 8, and by the reference there to the Aho et al. textbook.

Rejection of Claims under 35 U.S.C. 102 and 103

Claim 1: For the Examiner's convenience, new claim 42 is repeated below:

This claim stands rejected under 35 U.S.C. 102 or 103, as anticipated by or alternatively, as unpatentable over DeGraff. In response, amendments have been made to highlight further the novel and unobvious features recited in the claim.

As a preliminary matter of perspective with respect to the rejection of this and the other claims in view of DeGraff, the Examiner is respectfully reminded that embodiments of the invention described in the claims address the problem of finding an acceptable path from a start point S to a target point T in a *physical space*, as described above, compared to trying to find the best path from among the infinite number of possibilities. Obviously, to evaluate all the possible paths, in order to find the *best* path, even with the most powerful computer, would take forever.

At the other end of the spectrum are problems in which the possible path segments are predefined, such the road travel problem of DeGraff, in which the path segments are defined by a map and a database of cost for the segments. Finding the actual best path in the road travel problem in a finite time is possible, but in applicants' problem, some kind of tradeoff has to be made. The tradeoff chosen by applicants is to reduce computation cost in time and/or use of resources at the expense of finding the actual best path.

The following discussion will demonstrate by way of an example, the differences between claim 42 and DeGraff.

DeGraff is a travel guidance system of the kind described on page 7, lines 16-19 of the specification. As succinctly stated in the Abstract:

> ...The navigation system generally includes a database of road segments and a cost associated with the road segments, such as estimated time of travel across that road segment and estimated length of travel across that road segment. The navigation system determines a route from a selected beginning point to a desired destination by evaluating the cost of the road segments to be traveled in several potential routes and recommends the potential route having the lowest total cost. The user can selectively modify the cost of selected road segments to indicate a preference or avoidance of such roads...

Referring again to claim 42, the preamble focuses on the heart of the problem: finding a path from a start point to a target point from among a substantially infinite number of existing paths. That alone differentiates DeGraff, where the number of paths is finite and in fact predefined. This distinction is further emphasized in clause (a) which recites selecting a plurality of points in physical space wherein the locations of the plurality of selected points are comprised in the substantially infinite number of paths.

DeGraff does not compute path costs for selected points intermediate the start and target points, as recited in claim 42. Rather what is selected are route segments from a database. Moreover, DeGraff's database of a predetermined set of alternative routes is the exact opposite of what is dealt with in clause (a) recites. Thus DeGraff completely fails to satisfy clause (a) as well as clauses (b) and (c).

Clause (d) recites computing *estimated* costs to target. Nothing is estimated according to DeGraff.

Clause (e) calls for selecting a group of points for further consideration according to those points determined in (b) and (c) and clause (f) calls for calculating total path costs to

target based on approximated total path cost, Again, in contrast, nothing is estimated according to DeGraff.

Finally, clause (g) again emphasizes estimates total path costs and specifies that the ultimate selection is an acceptably accurate estimate of the lowest cost path. Again, DeGraff has no estimates.

Thus, it may be seen that DeGraff fails to satisfy the recitations of any of the clauses of claim 1.

As to the purported obviousness of modifying DeGraff to "use alternative routes", to exclude possible route segments from the evaluation because of traffic or user dislike would not be workable. A congested route or one the user would prefer to avoid might still be the best one, overall.

Claim 42 should be allowed for all these reasons.

Claims 3-9, 14-18, 22-24, and 27-33: Although the rejection is explicitly stated to be applicable only to claim 1, the Examiner appears to have applied it as well to claims 3-9, 14-18, 22-24, and 27-33. These claims are all directly or indirectly dependent on claim 42, and are patentable for the same reasons. In addition, these claims recite features which, considered in combination with the features of claim 1, are not disclosed, taught or suggested in DeGraff.

To give a few examples, claim 3 recites that "the accumulated path cost at the target point *approximates a minimal accumulated path cost*... In DeGraff, as stated by the Examiner, the lowest cost path is determined, not an approximation.

Claim 9 recites that the accumulated path cost of a point is a function of a local cost of the point and an accumulated path cost of at least one neighbor point of the point. DeGraff does not make calculations based on points, but on route segments. The only points of concern are the start point and the destination.

Regarding claim 14, there is no reference to a fast marching method in the text cited by the Examiner, nor anywhere else in DeGraff.

Regarding claims 23 and 24, DeGraff does not perform an *estimated*-cost-to-target computation. Rather, it computes the best path. Moreover, DeGraff does not decease or increase a *computed* value. All adjustments are made to the preexisting database values.

With regard to claim 27, authority concerning determining an optimum value is not relevant. The claim does not recite a value, but rather is directed to part of the method for determining the end result.

Claim 28 recites that *points* are categorized and points of different categories are processed differently. As explained above, DeGraff is not concerned with individual points, and there is accordingly no different processing of points of different categories.

Finally, claim 33 recites that the estimated cost-to-target computation is applied to 40% or less of the points for which the accumulated path cost has been computed. Even if it made sense to equate points with DeGraff's route segments, all the segments are involved in the computation, not 40% or less.

Claims 2, 10, 12, 20, and 25: These claims stand rejected under 35 U.S.C. 103, as unpatentable over DeGraff in view of Schneider, Jr. U.S. patent 5,394,325 (Schneider). This rejection is also respectfully traversed.

Schneider is concerned with processing geophysical data, and in particular with propagation of seismic waves. This is done by solving Eikonal equations to obtain a three-dimensional grid of velocities from which a three-dimensional grid of travel times is computed. Schneider's computations are performed in spherical coordinates, on a mainframe computer, or on a massively parallel processor. The inference is that Schneider's problem is so complex that there would be no hope for achieving a solution with a general purpose PC. What also stands out is that DeGraff's problem, in which the set of allowable path segments is predetermined, is child's play compared to that of Schneider. The problems to which the references are directed are entirely different.

The Examiner has not demonstrated any relationship between Schneider and DeGraff, or anything from which a person skilled in the art could imagine such a relationship. Why, for example, would a person having ordinary skill in the art want to consume the resources of the ultra-powerful computer required by Schneider's application, or use the ultra-powerful methods needed by Schneider for the relatively simple problem of DeGraff's travel guidance system? Nor has the Examiner shown how the references can be combined, if indeed, they it would even be possible to adapt Schneider's techniques for use in DeGraff without major redesign of both DeGraff and Schneider. Thus, there is nothing to indicate that Schneider overcomes or even can overcome any of the deficiencies in DeGraff.

Accordingly, there is nothing to suggest that claim 1 would be unpatentable over the combination of DeGraff and Schneider

Since all of claims 2, 10, 12, 20, and 25 are directly or indirectly dependent on claim 42, these claims are patentable for all the same reasons. In addition, these claims each recite

features, which, when considered in combination with the features of claim 42, are not disclosed, taught or suggested in DeGraff and Schneider, whether considered alone or together.

New Claim 34: This claim is directed to the tradeoff aspect of some embodiments of the invention. The claim is supported in the specification, for example, at page 2, line 29- at page 3, line 9; at page 7, lines 9-13; at page 13, lines 15-16; at page 17, line 28-page 19, line 2; at page 20, lines 1-6; and at page 22, lines 6-14.

The claim recites:

> A method according to claim 1, wherein use of said estimated cost to target minimizes computation time for a path that is an acceptable estimate of a minimum path cost from said start point to said target point.

As claim 34 is dependent on claim 42, it is patentable for all the reasons given above. Further, the idea of minimizing computation time at the expense of accuracy is the opposite of what DeGraff teaches. In the case of Schneider the problem requires massive computation power and is directed to finding the best solution and not a tradeoff. Claim 34 is patentable for this reason as well.

New Claims 35 and 36:

The derivation and support for claim 35 has been discussed above. Claim 36 is also derived from claim 1. This claim recites that the total path cost is the calculated cost from the start point to the intermediate point plus the estimated cost from said intermediate point to said end point, rather than "*a cost based on* the estimated cost from said intermediate point to said end point".

New Claim 37:

This claim is dependent on claim 42 and should be allowed for all the same reasons. Moreover, claim 37 recites that the data from which the path is determined is derived from medical data, and represents a path through a blood vessel or other body lumen. Nothing like this disclosed, taught or suggested in any of the references.

New Claims 38-41, 43, and 44:

Claim 38 is a combination of claims 42 and 8. Claims 39 and 40 are respectively, combinations of 7 plus 2 and 8 plus 2. Claim 41 is dependent on claim 22. Claim 43 is

extracted form original claim 1. Claim 44 is dependent on claim 42, and adds the features off claim 3. These claims are allowable for all the reasons stated in connection with their parent claims.

Allowability of Claims 13, 26, and 27

Preliminarily, it is respectfully submitted that the Office Action is ambiguous in respect to these claims. In the Office Action Summary, the subject claims are stated to be objected to (see item 7), and no rejection appears to have been applied to them. They are, in fact, not mentioned at all in the Detailed Action.

For purposes of this response, it is assumed that the claims in question are objected to for their dependency on rejected parent claim 1. In view of the amendments to claim 1, and the foregoing remarks, claims 13, 26, and 27 are being retained in dependent form pending further consideration of claim 1 by the Examiner.

In view of the foregoing, applicants respectfully submit that the application is in order for allowance. A notice thereof is respectfully awaited.

Respectfully submitted,

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Enclosed:

- Request for Continued Examination (RCE)